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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE.
BOARD OF PATENT APPEALS AND INTERFERENCES

In re patent application of:

Nowak et al.

Serial No.: 10/711,845

Filed: October 8, 2004

Group Art Unit: 2811

Examiner: Tran, Thien F.

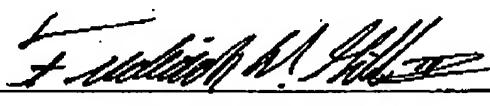
Atty. Docket No.: BUR920040150US1

For: FIN-TYPE ANTIFUSE

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Frederick W. Gibb, III

APPELLANTS' APPEAL BRIEF

Sirs:

Appellant respectfully appeals the final rejection of claims 1-7 and 27-39, in the Office Action dated October 3, 2005. A Notice of Appeal was timely filed on January 3, 2006.

I. REAL PARTY IN INTEREST

The real party in interest is International Business Machines Corp., Armonk, New York, assignee of 100% interest of the above-referenced patent application.

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II. RELATED APPEALS AND INTERFERENCES

There are no other appeals or interferences known to Appellants, Appellants' legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1-3 and 5 stand rejected under 35 U.S.C. §102(b) as being anticipated by Levy (U.S. Patent No. 5,469,379). Claims 1 and 6 stand rejected under 35 U.S.C. §102(b) as being anticipated by Hsu et al. (U.S. Patent No. 5,166,556). Claims 4, 7, 27-31, and 33-38 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Levy (U.S. Patent No. 5,469,379). Claims 27, 32, 34, and 39 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Hsu et al., hereinafter "Hsu" (U.S. Patent No. 5,166,556).

IV. STATUS OF AMENDMENTS

An after-final Response that made no claim amendments was filed on November 30, 2005. An Advisory Action dated December 29, 2004 indicated that, upon filing an appeal, the Response filed on November 30, 2005 did not place the application in condition for allowance, and that the rejections of claims would remain. The claims shown in the appendix are shown in their amended form as of the July 19, 2005 Amendment.

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V. SUMMARY OF CLAIMED SUBJECT MATER

The claimed comprises an antifuse that uses fin technology. This makes the inventive antifuses smaller than conventional fuses. Thus, the invention takes advantage of the fact that a fin of silicon is of very low mass (fractions of a picogram) and thus is easily heated electrically. The invention provides an inexpensive technique to make the antifuse change resistance by a large amount permanently after a pulse of heating current is passed through the fin. Because of the small area (mass) of the inventive structure, the operation of activating (blowing) the antifuse involves a simplified heating process that is performed by passing current through the antifuse. Therefore, not only does the invention produce smaller antifuses than are conventionally available, the invention also provides a method of activating the fuses that avoids the problems that can occur during conventional physical/optical antifuse activation.

As defined by the independent claims, and shown in the Figures attached to the application, the invention comprises "a fin having a center portion and end portions." The fin is shown, for example, in Figure 6 as item 200. The center portion is identified as item 600 and the end portions are shown as items 602 and 604. The claims further define that "said center portion of said fin comprises a substantially non-conductive region adapted to permanently become a conductor when heated above a predetermined temperature" and that the "end portions comprise conductors." The last line of paragraph 39 of the specification explains that the structure shown in Figure 6 includes a high-resistance center section 600 and conductive ends 602, 604.

Independent claim 1 most broadly defines the antifuse. The other independent claims narrow the definition of the fin. Thus, independent claim 27 defines that the "fin has a height and length that exceeds a width of said fin" and independent claim 34 defines that the "fin has a height and length that exceed more than 2 times a width of said fin." For example, the last portion of paragraph 36 explains that the fin 200 is a rectangular structure that extends from the substrate 100 and is more than a conventional rectangular wire. Thus, for example, the fin has a height (h) and length (l) that exceeds more than 2 times the width (w) of the fin.

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VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues presented for review are whether claims 1-3 and 5 are anticipated under 35 U.S.C. §102(b) by Levy (U.S. Patent No. 5,469,379); whether claims 1 and 6 are anticipated under 35 U.S.C. §102(b) by Hsu et al. (U.S. Patent No. 5,166,556); whether claims 4, 7, 27-31, and 33-38 are unpatentable under 35 U.S.C. §103(a) over Levy (U.S. Patent No. 5,469,379); and whether claims 27, 32, and 39 are unpatentable under 35 U.S.C. §103(a) over Hsu et al., hereinafter "Hsu" (U.S. Patent No. 5,166,556).

VII. ARGUMENT

A. The Rejection Based on Levy

1. The Position in the Office Action

The Office Action states:

Claims 1-3 and 5 are rejected under 35 USC 102(b) as being anticipated by Levy.

Levy discloses an antifuse structure (Figure 2) comprising a fin having a center portion 58 and end portions (55, 60), wherein said center portion of said fin comprises a substantially non-conductive region 58 (insulating amorphous silicon) which is capable of permanently becoming a conductor when heated above a predetermined temperature, wherein said end portions comprise conductors.

Regarding claim 2, said center portion of said fin comprises an amorphous material.

Regarding claim 3, it is inherent that said center portion of said fin is approximately 10 times more conductive after

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being heated above said predetermined temperature when compared to conductivity level of said center portion before heating.

Regarding claim 5, the center portion comprises amorphous silicon before transforming into polycrystalline silicon.

The limitations "being heated above said predetermined temperature" in claims 3 and 5 are taken to be product by process limitations. A product by process claim directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See In re Fessman, 180 USPQ 324, 326 (CCPA 1974); In re Marosi et al, 218 USPQ 289, 292 (Fed. Cir. 1983); and particularly In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985), all of which make it clear that it is the patentability of the final structure of the product "gleaned" from the process steps, which must be determined in a "product by process" claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old and obvious product produced by a new method is not a patentable product, whether claimed in "product by process" claims or not.

Claims 4 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Levy (USPN 5,469,379).

Levy as described above does not teach the antifuse structure comprising a center portion having less than approximately 10 percent of the length of the fin. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the center portion having less than 10 percent of the length of the fin, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233. In re Daily, 93 USPQ 47 (CCPA 1966), the court held that changes in size and shape of parts of an invention in the absence of an unexpected result involves routine skill in the art. Additionally, In Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), the Federal Circuit

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held that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device.

Regarding claim 7, Levy does not teach the antifuse structure comprising a fin having a height and length that exceeds more than 2 times a width of the fin. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the fin having a height and length that exceeds more than 2 times a width of the fin, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233. In re Daily, 93 USPQ 47 (CCPA 1966), the court held that changes in size and shape of parts of an invention in the absence of an unexpected result involves routine skill in the art. Additionally, In Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984), the Federal Circuit held that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentably distinct from the prior art device.

Regarding claims 28 and 35, said center portion of said fin comprises an amorphous material.

Regarding claims 29 and 36, it is inherent that said center portion of said fin is approximately 10 times more conductive after being heated above said predetermined temperature when compared to conductively level of said center portion before heating.

Regarding claims 31 and 38, the center portion comprises amorphous silicon before transforming into polycrystalline silicon.

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The limitations being heated above said predetermined temperature in claims 29, 31, 36 and 38 are taken to be product by process limitations. A product by process claim directed to the product per se no matter how actually made, In re Hirao, 190 USPO 15 at 17 (footnote 3) See In re Fessman, 180 USPO 324 326 (CCPA 1974); In re Marosi et al., 218 USPO 289 292 (Fed. Cir. 1983); and particularly In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1935), all of which make it clear that it is the patentability of the final structure of the product gleaned from the process steps, which must be determined in a product by process" claim, and not the patentability of the process. See also MPEP 2113. Moreover, an old and obvious product produced by a new method is not a patentable product, whether claimed in product by process" claims or not.

2. Appellants' Position

a. Independent Claim 1

Appellants respectfully traverse the anticipation and obviousness rejections that are based on Levy principally because the rejections takes an unreasonable position with respect to the term "fin" and for other reasons. One of the points of novelty of the claimed invention is an anti-fuse (a fuse that is an insulator until blown) that has a fin. It is apparent that during examination a clear example of a fin-type anti-fuse (as described in the specification and illustrated in the attached drawings) could not be located; however, in order to provide complete examination, a broad meaning of the claim term "fin" has been utilized. The Office Action correctly states that claims in a pending application should be given their broadest reasonable interpretation. However, one ordinarily skilled in the art would not consider the structure represented by items 55, 60, and 62 in Levy to reasonably be any form of "fin" as that term is commonly known, and this is especially true if one ordinarily skilled in the art interprets the claim language in light of the specification and drawings. Thus, as explained in greater detail below, Appellants submit

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that the Office Action, in attempting to provide complete and thorough examination, is being unreasonably broad with respect to the claim terminology.

For example, on page 7 in the "Response to Arguments" portion, the Office Action explains that the term "fin" is understood to be a projection that extends from a body. Appellants agree that a fin does extend from a body; however, not all projections from a body are fins. To the contrary, the use of the term fin within the rejections appears to equate any form of projection with a fin and it is Appellants position that such a broad interpretation of the term "fin" is not reasonable and would not be sustained upon appeal.

Appellants note that Levy does not describe the structures 55, 60, and 62 as any form of fin. To the contrary, Levy discloses a feature which is only described as "a programmable link 58", which is illustrated in Figures 2 and 3 as being rectangular in cross-section (column 3, line 53). There is no description within Levy which would indicate that the link 58 is formed in the shape of a fin. To the contrary, the remainder of Levy appears to indicate that the link 58 comprises a square or flat rectangle, or a disk-shaped structure that is not equivalent to the claimed structure which is explicitly defined to include "fin." The only description of the link 58 in Levy can be found in the paragraph appearing in column 3, lines 50-61, which describes that the link forms a selective connection between conductors 55 and 60. In this manner of description, the link 58 appears to be described as some type of a via between wiring layers 55 and 60. One ordinarily skilled in the art would understand that a via comprises flattened rectangular sections of wiring or openings filled with a material. Neither type of via could in any way be described as a fin structure because a via normally comprises a flattened square or disk of material that is wide and flat enough to reliably form an electrical connection between adjacent conductive structures. Therefore, Appellants submit that Levy clearly does not explicitly teach any type of fin structure and that the most that can be implied into the teachings of Levy is a flattened disk or rectangular structure.

While it is important to apply the broadest reasonable definition to terms used within claims in order to provide a quality examination of the claims, such interpretation of the language used within the claims cannot ignore the clear and unambiguous language within the

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claims. Here independent claim 1 defines a "fin" which is commonly understood to be a thin projection (which can be rectangular) that extends from a surface. The Office Action ignores the requirement in the claims for a "fin" and proposes that the link 58 within Levy (which is not described as being a fin and cannot reasonably be interpreted as being a fin, as described above) is somehow equivalent to the claimed fin structure. The terminology "fin" is not ambiguous and is a readily defined term found within common usage in many arts. Further, the specification fully describes the shape of the fin and illustrates the fin quite clearly in perspective view (Figure 6).

Therefore, Appellants respectfully submit that in this situation, the interpretation relied upon in the Office Action for the term "fin" would be considered unreasonably broad by one ordinarily skilled in the art, especially in light of the specification. By attempting to equate the link 58 in Levy with the term "fin" used in independent claim 1, the Office Action is attempting to render the term "fin" meaningless. If the interpretation of claim language would render the claim language meaningless, such an interpretation is overly broad and unreasonable.

b. Independent Claims 27 and 34

The overly broad interpretation of the term "fin" becomes even more unreasonable with the limitations in independent claims 27 and 34. Independent claim 27 goes further and defines that the "fin has a height and length that exceeds a width of said fin" and independent claim 34 goes even further and defines that the "fin has a height and length that exceed more than 2 times a width of said fin." As noted above, a broad interpretation has been applied to the claim term "fin." However, such an interpretation cannot apply to independent claims 27 and 34 because the relative dimensions of the fin are described. The Office Action argued that the claim differences between independent claims 27 and 34 and independent claim 1 are obvious based on discovering optimal or workable ranges. To the contrary, there is no fin in Levy upon which one ordinarily skilled in the art could discover optimal or workable ranges, much less one that has a height and length that exceed its width.

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More specifically, the rejection cites Figure 2 of Levy as comprising a fin having a center portion 58 and end portions (55, 60), however a closer examination of Levy reveals that (see col. 3, lines 55-61) layers 55 and 60 are 'metal conductors' and these are not included in a fin structure. More specifically, the 'cross points of the metal conductors 55 and 60 are separated by a non-conductive or "open" link' (col. 3, lines 60-61). So Levy explicitly teaches 55 and 60 to be separate wiring levels forming a cross point connection. To the contrary, the claims define a structure with a fin with end portions that are conductive and a center portion that is substantially non-conductive. A cross point is well understood to be to (conductive) wires running in a non-parallel (usually orthogonal) fashion to one another with a structure of interest formed at the intersection of the two wires. Thus, Levy would teach away from a fin structure where the end portions are typically parallel to one another and even collinear, incapable of forming a cross point. The structure of Levy would become inoperable as a fin structure, as it could not be formed by cross point wires without 'short-circuiting' the two wires. Further, the claimed invention is required to solve the problem of collinear ends of the fin surrounding the center portion.

The interpretation of the claim language within the rejections is further flawed where the rejections states that "product by process" limitations are included in the claim. More specifically, the second limitation in independent claim 1 describes that the center portion of the fin changes from non-conductive to a permanent conductor when heated. Product by process claim limitations describe a product according to the manner in which it is manufactured. One ordinarily skilled in the art of anti-fuses would clearly understand that the claimed limitation has nothing to do with the process for manufacturing the device, but instead has to do with how the device operates after it is manufactured. As is known in the art, when a fuse is blown, the fuse changes from a conductor into an insulator. Similarly, when an antifuse is blown, the anti-fuse changes from an insulator into a conductor. Thus, the second limitation in independent claim 1 would clearly be understood by one ordinarily skilled in the art not as a product by process limitation, but instead as an operating characteristic of the final structure. Here, the limitation does not relate to any manufacturing process, but instead further defines the operating

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characteristics of the previously manufactured device. Therefore, the position in the rejections with respect to the non-applicability of product by process limitations is misplaced.

Therefore, as shown above, Levy does not disclose or suggest the claimed "fin" defined by independent claims 1, 27, and 34. Failing to disclose a fin, Levy cannot teach or suggest that, in the fin "end portions comprise conductors" or that "said center portion of said fin comprises a substantially non-conductive region." Simply put, while Levy discloses an anti-fuse structure, Levy does not disclose or suggest any form of anti-fuse structure that includes a fin. Thus, Appellants respectfully submit that independent claims 1, 27, and 34 are not anticipated or rendered obvious by Levy. In view of the foregoing, the Board is respectfully requested to reconsider and withdraw these rejections.

c. **Dependent Claims 2-5, 7, 28-31, 33, and 35-38**

Further, dependent claims 2, 28, and 35 are similarly not anticipated by Levy. With respect to claims 2, 28, and 35 that define that the "center portion of said fin comprises an amorphous material" once again, Levy does not disclose any form of fin and, therefore, cannot logically teach that the center portion of the fin should be an amorphous material.

Claims 3, 29, and 36 define that the "center portion of said fin is approximately 10 times more conductive after being heated above said predetermined temperature when compared to a conductivity level of said center portion before heating." Since Levy does not disclose the fin, Levy cannot disclose any characteristics regarding the fin, such as its conductivity.

The Office Action rejects claims 4, 30 and 37 as obvious in light of Levy, however the invention of Levy requires that 55 and 60 be quite thick as the form 'cross point' wires and must be of very low resistance to be electrically operable, while the 'link' 58 must be thin to allow for heating with a low voltage. Since there is no "fin" taught in Levy, it is difficult to interpret exactly what '10% of the length of the fin' would mean in the work of Levy, however the art taught in Levy would be impractical with 58 having a length 10% of that of layers 60 or 55 as these layers are described as cross point wires which are typically the length of an entire cell

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array; this would be prohibitively large. Similarly the rejection of claims 7, 27, 33, and 34 are problematic in the work of Levy. The width of the layer 58 is lithographically determined and expected to be comparable to the height of the memory structure by one ordinarily skilled in the art.

Similarly, with respect to claims 5, 31, and 38 which define that the "center portion comprises amorphous silicon before being heated above said predetermined temperature and comprises polycrystalline silicon after being heated above said predetermined temperature" because Levy does not disclose the fin, it cannot disclose physical characteristics of the center portion.

Further, with respect to claims 7 and 33 which define "that the fin has a height and length that exceeds more than 2 times a width of said fin" as explained with respect to independent claim 34, Levy even more clearly does not teach the fin having such specific dimensions. In view of the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

B. The Rejections Based on Hsu

1. The Position in the Office Action

The Office Action states:

Claims 1 and 6 are rejected under 35 U.S.C. 102(b) as being anticipated by Hsu et al. (USPN 5,166,556).

Hsu et al. discloses an antifuse structure (Figure 2) comprising a fin having a center portion 30 and end portions (26, 32), wherein said center portion of said fin comprises a substantially non-conductive region (amorphous silicon-based dielectric) which is capable of permanently becoming a conductor when heated above a predetermined temperature, wherein said end portions comprise conductors.

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Regarding claim 6, the end portions (26, 32) comprise silicide regions of the fin.

Claims 27, 32, 34, and 39 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu et al. (USPN 5,166,556).

Hsu et al. as described above do not teach the antifuse structure comprising a fin having a height and length that exceeds more than 2 times a width of the fin. However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to form the fin having a height and length that exceeds more than 2 times a width of the fin, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233. In re Daily, 93 USPQ 47 (CCPA 1966), the court held that changes in size and shape of parts of an invention in the absence of an unexpected result involves routine skill in the art. Additionally, In Gardner v. TEC Systems, Inc. 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied 469 U.S. 830, 225 USPQ 232 (1984), the Federal Circuit held that where the only difference between the prior art and the claims was a recitation of relative dimensions of the claimed device and a device having the claimed relative dimensions would not perform differently than the prior art device, the claimed device was not patentable distinct from the prior art device.

Regarding claims 32 and 39, the end portions (26,32) comprises silicide regions of the fin.

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2. Appellants' Position

a. Independent Claim 1

Appellants respectfully traverse the anticipation and obviousness rejections because Hsu does not disclose (or suggest) the use of a fin within an antifuse structure. To the contrary, Hsu discloses an antifuse "layer" 30 that is illustrated in Figure 2 as being V-shaped in cross-section. There is no description within Hsu which would indicate that the antifuse layer 30 is formed in the shape of a fin.

One of the points of novelty of the claimed invention is an anti-fuse (a fuse that is an insulator until blown) that has a fin. It is apparent that during examination a clear example of a fin-type anti-fuse (as described in the specification and illustrated in the attached drawings) could not be located; however, in order to provide complete examination, a broad meaning of the claim term "fin" has been utilized. The Office Action correctly states that claims in a pending application should be given their broadest reasonable interpretation. However, one ordinarily skilled in the art would not consider the structure represented by layer 30 in Hsu to reasonably be any form of "fin" as that term is commonly known, and this is especially true if one ordinarily skilled in the art interprets the claim language in light of the specification and drawings. Thus, as explained in greater detail below, Appellants submit that the Office Action, in attempting to provide complete and thorough examination, is being unreasonably broad with respect to the claim terminology.

For example, on page 7 in the "Response to Arguments" portion, the Office Action explains that the term "fin" is understood to be a projection that extends from a body. Appellants agree that a fin does extend from a body; however, not all projections from a body are fins. To the contrary, the use of the term fin within the rejections appears to equate any form of projection with a fin and it is Appellants position that such a broad interpretation of the term "fin" is not reasonable.

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While it is important to apply the broadest reasonable definition to terms used within claims in order to provide a quality examination of the claims, such interpretation of the language used within the claims cannot ignore the clear and unambiguous language within the claims. Here independent claim 1 defines a "fin" which is commonly understood to be a thin projection (which can be rectangular) that extends from a surface. The Office Action ignores the requirement in the claims for a "fin" and proposes that the antifuse layer 30 within Hsu (which is not described as being a fin and cannot reasonably be interpreted as being a fin) is somehow equivalent to the claimed fin structure. The terminology "fin" is not ambiguous and is a readily defined term found within common usage in many arts. Further, the specification fully describes the shape of the fin and illustrates the fin quite clearly in perspective view (Figure 6). Therefore, Appellants respectfully submit that in this situation, the interpretation relied upon in the Office Action for the term "fin" is unreasonably broad. By attempting to equate the V-shaped antifuse layer 30 in Hsu with the term "fin" used in independent claim 1, the Office Action is attempting to render the term "fin" meaningless. If the interpretation of claim language would render the claim language meaningless, such an interpretation is overly broad and unreasonable.

The Office Action suggests that 26, 32 comprise end portions of a fin with center portion 30. Inspection of Hsu, however, reveals key elements that are missing from the claimed invention. In particular the antifuse of Hsu comprises "a layer 26 of titanium, or other refractory metal or metal silicide, thicker than 50nm" (col. 6 lines 11, 12) and "a layer 32 of more than 50 nanometers of titanium or other refractory metal or metal silicide" (col. 6 lines 23, 24) and "30 nanometers to 400 nanometers of an off-stoichiometric amorphous silicon-based dielectric layer" (col. 6 lines 17-19) which is sandwiched between 26 and 32. Note that these three portions of the antifuse of Hsu are three distinct layers of materials. The structure of Hsu would not be operable as a fin. The first layer 26 could not support the dielectric layer 30 with a contacted layer 32 above since such a structure would result in a direct connection between layers 26 and 32. Additionally, the contact opening 28 would straddle the entire fin and also 'short-circuit' a fin structure. Thus, the structure of Hsu would not be operable as a fin.

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Therefore, as shown above, Hsu does not disclose or suggest the claimed "fin" defined by independent claim 1. Failing to disclose a fin, Hsu cannot teach or suggest that, in the fin "end portions comprise conductors" or that "said center portion of said fin comprises a substantially non-conductive region." Simply put, while Hsu discloses an anti-fuse structure, Hsu does not disclose or suggest any form of anti-fuse structure that includes a fin. Thus, Appellants respectfully submit that independent claim 1 is patentable over Hsu.

b. Independent Claims 27 and 34

The overly broad interpretation of the term "fin" becomes even more unreasonable with the limitations in independent claims 27 and 34. Independent claim 27 goes further and defines that the "fin has a height and length that exceeds a width of said fin" and independent claim 34 goes even further and defines that the "fin has a height and length that exceed more than 2 times a width of said fin." As noted above, a broad interpretation has been applied to the claim term "fin." However, such an interpretation cannot apply to independent claims 27 and 34 because the relative dimensions of the fin are described. The Office Action argued that the claim differences between independent claims 27 and 34 and independent claim 1 are obvious based on discovering optimal or workable ranges. To the contrary, there is no fin in Hsu upon which one ordinarily skilled in the art could discover optimal or workable ranges, much less one that has a height and length that exceed its width.

The interpretation of the claim language within the rejections is further flawed where the rejections states that "product by process" limitations are included in the claim. More specifically, the second limitation in independent claim 1 describes that the center portion of the fin changes from non-conductive to a permanent conductor when heated. Product by process claim limitations describe a product according to the manner in which it is manufactured. One ordinarily skilled in the art of anti-fuses would clearly understand that the claimed feature has nothing to do with the process for manufacturing the device, but instead has to do with how the device operates after it is manufactured. As is known in the art, when a fuse is blown, the fuse

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changes from a conductor into an insulator. Similarly, when an antifuse is blown, the anti-fuse changes from an insulator into a conductor. Thus, the second limitation in independent claim 1 would clearly be understood by one ordinarily skilled in the art not as a product by process limitation, but instead as an operating characteristic of the final structure. Here, the limitation does not relate to any manufacturing process, but instead further defines the operating characteristics of the previously manufactured device. Therefore, the position in the rejections with respect to the non-applicability of product by process limitations is misplaced.

Therefore, as shown above, Hsu does not disclose or suggest the claimed "fin" defined by independent claims 1, 27, and 34. Failing to disclose a fin, Hsu cannot teach or suggest that, in the fin "end portions comprise conductors" or that "said center portion of said fin comprises a substantially non-conductive region." Simply put, while Hsu discloses an anti-fuse structure, Hsu does not disclose or suggest any form of anti-fuse structure that includes a fin. Thus, Appellants respectfully submit that independent claims 1, 27, and 34 are not anticipated or rendered obvious by Hsu. In view of the foregoing, the Board is respectfully requested to reconsider and withdraw these rejections.

c. Dependent Claims 6, 32, and 39

Claims 6, 32, and 39 define that the "end portions comprise silicide regions of said fin." Once again, because Hsu does not disclose any form of fin, it cannot disclose anything about the fin, such that the end portions are silicided. In view of the foregoing, the Board is respectfully requested to reconsider and withdraw this rejection.

VIII. CONCLUSION

Appellants respectfully traverse the anticipation and obviousness rejections that are based on Levy and Hsu principally because the rejections takes an unreasonable position with respect to the term "fin" and for other reasons. One of the points of novelty of the claimed invention is

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an anti-fuse (a fuse that is an insulator until blown) that has a fin. It is apparent that during examination a clear example of a fin-type anti-fuse (as described in the specification and illustrated in the attached drawings) could not be located; however, in order to provide complete examination, a broad meaning of the claim term "fin" has been utilized. The Office Action correctly states that claims in a pending application should be given their broadest reasonable interpretation. However, one ordinarily skilled in the art would not consider the structure represented by items 55, 60, and 62 in Levy or the structure represented by layer 30 in Hsu to reasonably be any form of "fin" as that term is commonly known, and this is especially true if one ordinarily skilled in the art interprets the claim language in light of the specification and drawings (e.g., Appellants' Figure 6). Thus, as explained in greater detail above, Appellants submit that the Office Action, in attempting to provide complete and thorough examination, is being unreasonably broad with respect to the claim terminology and the applied prior art reference do not teach or suggest a reasonable interpretation of the claimed invention.

In view of the forgoing, the Board is respectfully requested to reconsider and withdraw the rejections of claims 1-7 and 27-39. Please charge any deficiencies and credit any overpayments to Attorney's Deposit Account Number 09-0456.

Respectfully submitted,

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VIII. CLAIMS APPENDIX

1. (Original) An antifuse structure comprising:
a fin having a center portion and end portions,
wherein said center portion of said fin comprises a substantially non-conductive region
adapted to permanently become a conductor when heated above a predetermined temperature,
wherein said end portions comprise conductors.
2. (Original) The antifuse in claim 1, wherein said center portion of said fin comprises an
amorphous material.
3. (Original) The antifuse in claim 1, wherein said center portion of said fin is
approximately 10 times more conductive after being heated above said predetermined
temperature when compared to a conductivity level of said center portion before heating.
4. (Original) The antifuse in claim 1, wherein said center portion comprises less than
approximately 10 percent of the length of said fin.
5. (Original) The antifuse in claim 1, wherein said center portion comprises amorphous
silicon before being heated above said predetermined temperature and comprises polycrystalline
silicon after being heated above said predetermined temperature.
6. (Previously Presented) The antifuse in claim 1, wherein said end portions comprise
silicide regions of said fin.
7. (Original) The antifuse in claim 1, wherein said fin has a height and length that exceeds
more than 2 times a width of said fin.

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8-26. (Cancelled).

27. (Previously Presented) An antifuse structure comprising:

a fin having a center portion and end portions, wherein said fin has a height and length that exceeds a width of said fin,

wherein said center portion of said fin comprises a substantially non-conductive region adapted to permanently become a conductor when heated above a predetermined temperature, and

wherein said end portions comprise conductors.

28. (Previously Presented) The antifuse in claim 27, wherein said center portion of said fin comprises an amorphous material.

29. (Previously Presented) The antifuse in claim 27, wherein said center portion of said fin is approximately 10 times more conductive after being heated above said predetermined temperature when compared to a conductivity level of said center portion before heating.

30. (Previously Presented) The antifuse in claim 27, wherein said center portion comprises less than approximately 10 percent of the length of said fin.

31. (Previously Presented) The antifuse in claim 27, wherein said center portion comprises amorphous silicon before being heated above said predetermined temperature and comprises polycrystalline silicon after being heated above said predetermined temperature.

32. (Previously Presented) The antifuse in claim 27, wherein said end portions comprise silicide regions of said fin.

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33. (Previously Presented) The antifuse in claim 27, wherein said height and said length of said fin exceed more than 2 times said width of said fin.

34. (Previously Presented) An antifuse structure comprising:
a fin having a center portion and end portions, wherein said fin has a height and length that exceed more than 2 times a width of said fin,
wherein said center portion of said fin comprises a substantially non-conductive region adapted to permanently become a conductor when heated above a predetermined temperature, and
wherein said end portions comprise conductors.

35. (Previously Presented) The antifuse in claim 34, wherein said center portion of said fin comprises an amorphous material.

36. (Previously Presented) The antifuse in claim 34, wherein said center portion of said fin is approximately 10 times more conductive after being heated above said predetermined temperature when compared to a conductivity level of said center portion before heating.

37. (Previously Presented) The antifuse in claim 34, wherein said center portion comprises less than approximately 10 percent of the length of said fin.

38. (Previously Presented) The antifuse in claim 34, wherein said center portion comprises amorphous silicon before being heated above said predetermined temperature and comprises polycrystalline silicon after being heated above said predetermined temperature.

39. (Previously Presented) The antifuse in claim 34, wherein said end portions comprise silicide regions of said fin.

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IX. EVIDENCE APPENDIX

There is no other evidence known to Appellants, Appellants' legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

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X. RELATED PROCEEDINGS APPENDIX

There is no other related proceedings known to Appellants, Appellants' legal representative or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.